

SECTION 02713
EXTERIOR WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

0.1 DESCRIPTION OF WORK

- A.** Work Included: This Section specifies furnishing, installing, testing and disinfecting permanent water supply and fire protection mains and distribution piping.
- B.** Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 02300 - EARTHWORK.
 - 2. Section 02650 - EXISTING SITE UTILITIES.
 - 3. Section 03300 - CAST-IN-PLACE CONCRETE.

0.2 SUBMITTALS

- A.** Submit to the Engineer shop drawings showing the details, procedures, and scheduling for water utility Owner when the Authority's main is ready for connection to utility Owner's meter or piping. Shop drawings shall include maximum anticipated working pressure in each main and branch, the proposed pressure test pressure, and fittings material class.
- B.** Submit to both the Engineer and the water utility Owner detailed hydrostatic test and disinfection plans, including all proposed materials, concentrations, equipment, temporary piping, valving, connections, flow rates, equipment, methods of metering and measuring, and method of flushing and disposal.
- C.** Submit to both the Engineer and the water utility Owner for acceptance all manufacturer's and independent laboratory certified test reports as specified above and in cited standards.

0.3 QUALITY ASSURANCE

- A.** Lining Toxicity Test
 - 1. Procedure: FDA Method of Testing for Toxicity of Coating Material Intended for Use in Transporting or Holding Food or Potable Water.
 - 2. Requirements: Certified test results by pipe manufacturer; no more than 18 mg. per square inch exposed surface and no more than 50 ppm by weight of the water capacity of the test container, of

chloroform-soluble extractives, corrected for zinc extractives such as zinc oleate.

B. Field Pressure and Leakage Tests

1. Ductile Iron: AWWA C 600
2. Steel: AWWA C 600

C. Chlorine Residual Test

1. Test Method
 - a. During Disinfection: AWWA Manual M12, APHA/AWWA Standard methods drop dilution, Method E.
 - b. At End of Retention Period: APHA/AWWA Standard methods OTA or Amperometric Titration, Method D or F.
 - c. After Post-Disinfection Flush: APHA/AWWA Standard Methods Amperometric Titration, Method F.
2. Requirements
 - a. Test to be performed by approved independent testing laboratory. Certified test results to meet requirements of AWWA C 601 and water utility Owner.
 - b. In lieu of independent testing laboratory, Contractor may subcontract for water utility Owner to conduct residual chlorine testing at Contractor's expense.

D. Bacteriologic Tests

1. Procedure: AWWA C 601 and APHA/AWWA Standard Methods.
2. Requirements: Zero coliform organisms, and meet requirements of water utility Owner and public health authority. Certified tests by approved independent testing laboratory or by public health authority at Contractor's expense.

0.4 JOB CONDITIONS

A. Relations with Utility Owner

1. Establish through the Engineer a direct and continuous contact with the utility Owner to which the Authority's new distribution piping will be connected.
2. In all cases, verify from the utility Owner the maximum working pressure than can be encountered at point of interface with utility Owner's piping, and indicate this pressure on the shop drawings.
3. Do not cut into utility Owner mains or piping. The utility Owner will schedule and conduct interruption of utility services, perform cutting-in, and provide service meter at each point where new Authority

- piping is to be connected to the utility Owner mains and piping, at the expense of the Authority.
4. Do not connect to utility Owner meter or piping without written authorization from the utility Owner. Connection shall be made by the Contractor or utility Owner as indicated.
 5. If agreed to by the utility Owner, the Contractor may, at his own expense, elect to have all or any part of the disinfection work performed by the utility Owner.
- B. Cross-Connections:** Do not connect or cross-connect Authority fire water distribution piping with other Authority water piping; except that suitable approved temporary cross-connections may be made for disinfection only, providing that all such temporary cross-connections are removed after disinfecting. Fire distribution piping may be disinfected separately from metered water distribution piping to eliminate need for cross connections.
- C. Disinfection:** Disinfect both domestic and service water piping and fire water piping.

PART 2 - PRODUCTS

0.1 PIPE

- A. Ductile Iron Pipe:** AWWA C 151 thickness class as indicated; double-thickness cement-mortar lined; with push-on or mechanical joints except where flanges are indicated.
- B. Steel Pipe:** AWWA C 200, type, grade, and thickness as indicated, lined, coated, wrapped and jacketed in accordance with AWWA C 203 with Type A primer, Type 2 enamel, standard wrap and kraft jacket, plain ends for mechanical couplings, 8 inch band each end free of external coating and wrap.
- C. Asbestos-Cement Pipe:** AWWA C 400, Class 150, Type II.

0.2 FITTINGS

- A. For Ductile Iron Asbestos-Cement Pipe, and all Transitions:** AWWA C 110; ductile iron; 150 psi minimum rating; cement-mortar lined; with mechanical joints except where flanges are indicated.
- B. For Steel Pipe:** ANSI B16.5; class as indicated; lined, coated, and wrapped as specified for steel pipe.
- C. Couplings for Steel Pipe:** Flexible mechanical couplings, primed with AWWA C 203 Type A Primer; with steel bolts bituminous coated.

0.3 FLANGES

- A.** For Ductile Iron Pipe: AWWA C 110, coated and lined as specified for iron pipe.
- B.** For Steel Pipe: Welded slip-on type flanges, ASTM A 181 or ANSI B16.5 150-pound standard flanged mechanical coupling adaptor, bituminous lined inside and AWWA Type A bituminous primed outside in accordance with AWWA C 203 requirements, flange to mate with AWWA C207, ANSI B16.1, or ANSI B16.5 flange as required; bituminous coated steel bolts.
- C.** Flange Gaskets: ANSI B16.21 neoprene, 1/8 inch thick.

0.4 VALVES

- A.** For Service and Domestic Water: Type and size as indicated, conforming to the following:
 - 1. Yard Faucets and Miscellaneous through 2-1/2 inches: Approved MSS Standard globe and angle valves, malleable iron or cast bronze.
 - 2. Gate, three inch and larger: AWWA C 500.
 - 3. Butterfly, three inch and larger; AWWA C 504.
 - 4. Check: AWWA C 506 double or approved commercial single.
- B.** For Fire Water: Type and size as indicated, Class as required, U.L. listed.
- C.** Valve Boxes: ASTM A48, 30B minimum, screw type adjustable length, stay-put type removable cover with the word WATER or FIRE as applicable.
- D.** Precast Vaults: ASTM C 139, air-entrained, and Section 03300 - CAST-IN-PLACE CONCRETE.
- E.** Cast-In-Place Vaults: Section 03300 - CAST-IN-PLACE CONCRETE, Class 4000-3/4.
- F.** Iron Castings: ASTM A48, 30B minimum, with lettering as indicated.

0.5 FIRE HYDRANTS

- A.** Hydrants shall conform to the "standard for Dry-Barrel Fire Hydrants" ANSI/AWWA C 502-85. Hydrants shall be designed for 150 psi service and for installation in a trench with 5 foot cover (5-1/2 feet bury hydrant). Hydrant barrel extensions shall be furnished and installed as necessary to achieve correct bury depth. The length of the hydrant barrel shall be such that when installed with the proper depth of cover on the branch pipeline, the hydrant will be set with the normal ground line of the barrel within 3-inches of the actual ground grade surface elevation.

- B.** Hydrants shall be fabricated to manufacturer's standard pattern and size and shall have one 4-1/2 inch steamer and two 2-1/2 inch hose nozzles all with National Standard Thread (NST). Hydrant inlet opening on shoe shall have mechanical joints for accepting 6-inch ductile or cast iron pipe.
- C.** Hydrants shall open clockwise and shall be marked with an arrow and word "OPEN" to indicate the direction of turn of the stem to open the hydrant.
- D.** Hydrants shall have a compression type main valve, opening against and closing with water pressure. The main valve opening at the base of the hydrant shall have a minimum area of 39 square inches (5-inch minimum diameter circle). Each hydrant shall have "traffic" type ground line construction (breakaway bolts not acceptable) and permit 360-degree movement of the upper barrel to allow for any alignment without shutting down service and/or removing flange bolts and nuts. Hydrant operating nut shall be 1-1/2 inches, flat to point, pentagonal. Connecting pipe and pipe nipples between the main line tee and hydrant shall be 6-inch ductile iron conforming to the requirements for ductile iron pipe.
- E.** Hydrants shall be hydrostatically tested as specified in AWWA C 502.
- F.** Hydrant tees shall be anchor type. The branch shall have a plain end with an integral gland and rotating mechanical joint restraints. Every hydrant shall be equipped with a 6-inch shut-off valve, bolted or anchored to the hydrant tee. (NTS: Paragraph A - Hydrants for use in Maine to be furnished without drains.)

0.6 SERVICE CONNECTIONS

- A.** As required by the municipality involved or as specified in the Construction Specifications.

0.7 COUPLINGS

- A.** Pressure rating at least equal to that of related pipeline with a minimum rating of 150 psi.
- B.** Couplings shall be of a type equal to Smith Blair, Style 441; Dress, Style 153; 360 or Romac Style 501 or an approved equal. Couplings shall be provided with plain, Grade 27, rubber gaskets and with black steel, track-head bolts with nuts. Couplings shall be manufactured in the United States of America.

0.8 JOINTS

- A.** Provide mechanical joint or push-on joint pipe with necessary accessories, conforming to ANSI A21.11.

1. Provide gasket composition suitable for exposure to liquid within pipe.
 2. Provide gasket composition suitable for exposure to potable water.
 3. Provide mechanical joint gaskets with copper tips to provide electrical continuity.
 4. Provide serrated brass wedges for push-on joints to provide electrical continuity; two per joint for pipe 12-in. and smaller and four per joint for larger pipe.
- B.** Restrained joints shall be furnished for installation on all fittings, sleeves, hydrants and valves. Restraints for mechanical joints shall be Megalug Series 1100 as manufactured by Ebaa Iron Co., Uni-flanged Series 1400 Mechanical Joint Restraint or equal. Restraints for push on joints shall be Series 1700 as manufactured by Ebaa Iron Co., or Series 1390 as manufactured by Uni-Flange.
- C.** Restraint systems for push-on pipe utilizing steel-wedge gaskets will be acceptable.

0.9 INSULATION

- A.** Insulation shall be manufactured by Thermal Pipe Systems, Braintree, Massachusetts, Atlas Insulation, Ayer, Massachusetts or Insulated Piping Systems, Inc., Canton, Massachusetts, or equal. Insulation shall be factory formed-in-place polyurethane foam insulation having nominal thickness of 3", with an in-place density of 2.5 pcf, and a "K" factor of 0.14 BUT/in./hr/deg. F/sq. ft. Straight joints between insulated pipe lengths, and the end section of non-insulated pipe shall be 20-gauge corrugated aluminum performed to be fastened with stainless steel screws and bands. Jackets shall have expansion joints at 25-foot intervals. Sections of jacket shall have 2-inch minimum at all seams.
- B.** Jacket shall have one layer of one mil polyethylene film with a protective coat of 40-lb. virgin draft paper to act as a moisture and galvanic corrosion barrier.

0.10 SERVICES

- A.** All services shall be Type K Copper Tubing.

0.11 CORPORATIONS, CURB STOPS AND SADDLES

- A.** The corporation stops shall meet the most recent revision of the AWWA standard "Threads for Underground Service Line Fittings" (AWWA C 800). Corporation stops shall be designed for 175 psi pressure and have full keyway and rigid liners.

- B.** Curb stops shall include a drain suitable for use with polyethylene tubing specified hereinbefore. Stops shall have integral checks, O-ring seal and shall be furnished with rigid liners.
- C.** Curb stop boxes shall be cast iron Buffalo type with recessed lid with pentagon bolt, adjustable sliding type.
- D.** Surface saddles for 2 inch taps shall be double strap with bodies of ductile iron. The straps shall be electrogalvanized carbon steel. Units shall be complete with Buna N gaskets.

0.12 TAPPING SLEEVES AND VALVES

- A.** Tapping sleeves shall be mechanical joint type.
- B.** Tapping valves shall meet the requirements of AWWA C 500. The valves shall be flanged by mechanical joint outlet with non-rising stem and designed for vertical burial. Tapping valves shall be rated at 200 psi working pressure and shop tested at 300 psi. Bolts on bonnet and stuffing box shall be stainless steel (316 stainless steel), stuffing boxes shall be "O" ring type. The operating nut shall be 2-inches square. The valve shall be provided with oversized seat to permit use of full size cutters. Gaskets shall cover the entire flange surface. Valves shall open right (clockwise).
- C.** Valves shall be Mueller H-667 or approved equal.
- D.** Valve boxes shall be provided for each gate valve and tapping sleeve and valve.

PART 3 - EXECUTION

0.1 EXCAVATIONS

- A.** Conform to the requirements of Section 02300 - EARTHWORK and the AWWA Standards and Manual cited herein.
- B.** Dewater as required and disinfect excavation in accordance with Section 11 of AWWA C 601 where required.

0.2 INSTALLATION

- A.** Vaults: Install vaults as indicated. Provide six inches of backfill sand bedding for precast vaults. Construct cast-in-place vaults generally as specified for manholes, Section 02400 - DRAINAGE AND SEWER SYSTEMS. Provide pervious backfill subdrains and drainage as indicated or required for proper drainage.

B. Pipe Laying:

1. Install ductile iron pipe, fittings, and valves in accordance with AWWA C 600. Install steel pipe, fittings, and valves in accordance with AWWA C 200 and AWWA Manual M11. Install asbestos cement pipe in accordance with AWWA C 603.
2. Inspect all pipe, fittings and valves for soundness and for imperfections of coatings, wrappings and linings prior to installation.
3. Deflection at joints shall not exceed the maximum recommended by the pipe or coupling manufacturer for each type of coupling and each size of pipe.
4. Blocking will be permitted only where indicated.
5. Field welding will be permitted only where specifically authorized. Pipe may be cut in the field by approved means. After welding or cutting, repair damage to linings and coatings and prime and inspect the cut surface as specified in AWWA C 203, Section 2.14. Repair damaged cement linings in accordance with AWWA C 602 Section 16, or discard the pipe.
6. Prime steel pipe couplings and exposed pipe ends before installation, but do not enamel or wrap until after hydrostatic leak test.
7. Install all temporary piping, valving, meters, gages, and equipment required for hydrostatic testing and disinfection in accordance with approved shop drawings.

C. Anchorages and Buttresses

1. Construct concrete anchorages and buttresses where indicated. The soil bearing area shall not be less than indicated.
2. Harness all valves and fittings not provided with an anchor, buttress or restrained joint with steel rods and rod socket pipe clamps or by steel rods and rod connectors connected to mechanical joint bolts as indicated.

D. Fittings and valves shall be restrained for the minimum lengths listed on the following table:

| MINIMUM RESTRAINED LENGTHS | |
|----------------------------|---------------------------|
| FITTING | RESTRAINT LENGTH |
| 12" - 45° Bend | 13-feet in each Direction |
| 8" - 45° Bend | 9-feet in each Direction |
| 6" - 45° Bend | 7-feet in each Direction |
| 12" - 22-1/2° Bend | 6-feet in each Direction |
| 10" - 45° Bend | 11-feet in each Direction |
| 8" - 90° Bend | 23-feet in each Direction |
| 8" - 22-1/2° Bend | 4-feet in each Direction |
| 8" - 11-1/4° Bend | 2-feet in each Direction |
| 6" - 22-1/2° Bend | 3-feet in each Direction |

| | |
|-----------------------|-------------------------------|
| 6" - 11-1/4° Bend | 2-feet in each Direction |
| 12" - 11-1/4° Bend | 3-feet in each Direction |
| 12" Vertical Offset | |
| Upper 45° Bend | 27-feet in each Direction |
| Lower 45° Bend | 12-feet in each Direction |
| 8" Vertical Offset | |
| Upper 45° Bend | 19-feet in each Direction |
| Lower 45° Bend | 8-feet in each Direction |
| 6" Vertical Offset | |
| Upper 45° Bend | 14-feet in each Direction |
| Lower 45° Bend | 6-feet in each Direction |
| 12" x 12" x 12" Tee | 42-feet in Branch |
| 12" x 12" x 10" Tee | 29-feet in Branch |
| 12" x 12" x 8" Tee | 16-feet in Branch |
| 12" x 12" x 6" Tee | 1-foot in Branch |
| 8" x 8" x 8" Tee | 25-feet in Branch |
| 8" x 8" x 6" Tee | 10-feet in Branch |
| 8" x 8" x 4" Tee | 1-foot in Branch |
| 6" x 6" x 6" Tee | 15-feet in Branch |
| 6" x 6" x 4" Tee | 1-foot in Branch |
| 16" x 12" Reducer | 32-feet Larger Direction only |
| 12" x 10" Reducer | 28-feet Larger Direction only |
| 12" x 8" Reducer | 31-feet Larger Direction only |
| 12" x 6" Reducer | 42-feet Larger Direction only |
| 8" x 6" Reducer | 17-feet Larger Direction only |
| 8" x 4" Reducer | 29-feet Larger Direction only |
| 6" x 4" Reducer | 16-feet Larger Direction only |
| 12" Valve or Dead-end | 58-feet in each Direction |
| 10" Valve or Dead-end | 49-feet in each Direction |
| 8" Valve or Dead-end | 41-feet in each Direction |
| 6" Valve or Dead end | 31-feet in each Direction |
| 4" Valve or Dead-end | 22-feet in each Direction |
| 2" Valve or Dead-end | 18-feet in each Direction |

1. Lengths shown are based on 150 psi test pressure, 4-1/2-foot bury, soil type GP, trench Type 3, and 2:1 safety factor. Changes in conditions will require revision in lengths.

0.3 TESTING AND DISINFECTING

A. Hydrostatic Tests

1. Conduct both pressure test and leakage test by the open trench method as specified in AWWA C 600. Conduct leakage test as soon as practicable after completion of the pressure test.
2. Conduct all hydrostatic tests in the presence of the Engineer, and prior to coating joints and disinfecting. Do not conduct any hydrostatic tests until after all associated concrete work has cured for

a minimum of 7 days for standard concrete and at least 36 hours for high early strength concrete.

3. As soon as practicable after completion of hydrostatic tests, drain lines in an approved manner, and disconnect and remove temporary test piping and equipment which will no longer be required.

- B.** Field Coating. After completion of hydrostatic tests and before disinfecting, prime or reprime as required and coat all uncoated metal components of the piping system, including joints, harnesses and tie rods, generally as specified in AWWA C 201 for mechanical couplings, except that exposed ends of steel pipe up to the coupling shall be wrapped with hot applied coal tar tape. Inspect field-applied bituminous coatings for holidays as specified in AWWA C 203.
- C.** Disinfection. Disinfect and test all lines in accordance with the requirements of AWWA C 601 and as specified herein. Disinfect before final backfill around hydrants and valves. Remove disinfection equipment and temporary piping after approval of the disinfection tests.
- D.** Operating Tests. Following approval of the disinfection, conduct operating tests in the presence of the Engineer to verify that each valve and hydrant is in proper working condition. Whenever practicable, conduct operating tests during flushing of chlorine from the line.

0.4 BACKFILLING

- A.** Conform to the requirements of Section 02300 - EARTHWORK and the AWWA standards and Manuals cited herein.

PART 4 - MEASUREMENT AND PAYMENT

0.1 MEASUREMENT

- A.** Pipe including fittings will be measured per linear foot for each type and size, along the centerline with deductions for valves.
- B.** Vaults, hydrants, valves, tapping sleeves and valve boxes shall be measured per each by type and size.
- C.** Bedding material, porous fill, joints, couplings, fittings, tie rods, rod, couplings, pipe clamps, coatings, and hydro static testing will not be measured separately for payment and shall be considered incidental to the item of work for which it pertains.
- D.** Excavation and backfill materials shall be measured in accordance with Section 02300 - EARTHWORK. Concrete shall be paid for in accordance with Section 03300 - CAST-IN-PLACE CONCRETE.

- E.** Hydrant Removed and Reset shall be measured per each hydrant removed and relocated. Hydrant shall consist of hydrant, riser stem and hydrant shoe as one unit. Measurement for proposed piping shall begin at the face of the hydrant shoe.
- F.** Water Supply Piping shall be measured as a lump sum for the design of the proposed water service.

0.2 PAYMENT

- A.** Pipe for exterior water distribution systems shall be paid for at the Contract unit price per linear foot of piping installed complete in-place by size and type. Payment shall be full compensation for all labor, materials and equipment required piping in the sizes and types shown on the Drawings.
- B.** Hydrant Removed and Reset shall be paid at the Contract unit price for each hydrant removed and relocated. Payment shall be all labor, materials and equipment required to relocate hydrant to proposed locations as shown on the Drawings.
- C.** Gate Valves and Boxes shall be paid for at the Contract unit price per each gate valve installed complete in-place by size. Payment shall include all labor, material and equipment required to install gate valves in sizes and locations shown on the Drawings including PVC access pipe, masonry foundations and the cast iron frame and cover.
- D.** Tapping Sleeves shall be paid for at the Contract unit price per each tapping sleeve and valve installed complete in-place. Payment shall be full compensation for all labor, material and equipment required to install tapping sleeves in sizes and locations shown on the Drawings including PVC access pipe, tapping gate valve, masonry foundations and the cast iron frame and cover.
- E.** Excavation, Backfill and Gravel installed as part of the exterior water distribution systems shall be paid for in accordance with Section 02300 - EARTHWORK. Concrete installed as part of exterior water distribution systems shall be paid for in accordance with Section 03300 - CAST-IN-PLACE CONCRETE. Utility Structure Adjusted as part of exterior water distribution systems shall be paid for in accordance with Section 02650 - EXISTING SITE UTILITIES.
- F.** Water Supply Piping shall be paid for at the contract lump sum price for the design of the proposed water service. Payment shall be full compensation for all labor, material and equipment required to complete the design of the proposed water service, including coordination with the BWSC and the Engineer.

0.3 PAYMENT ITEMS

| ITEM NO. | DESCRIPTION | UNIT |
|----------|--|------|
| 1520.106 | 6" GATE AND GATE BOX | EA |
| 1520.108 | 8" GATE AND GATE BOX | EA |
| 1520.397 | 12"x4" TAPPING SLEEVE, VALVE AND BOX | EA |
| 1520.420 | 12"x6" TAPPING SLEEVE, VALVE AND BOX | EA |
| 1521.000 | WATER SUPPLY PIPING | LF |
| 1521.047 | 4" DUCTILE IRON WATER MAIN CEMENT LINED | LF |
| 1521.050 | 6" DUCTILE IRON WATER MAIN CEMENT LINED | LF |
| 1521.062 | 12" DUCTILE IRON WATER MAIN CEMENT LINED | LF |
| 1521.078 | 8" DUCTILE IRON PIPE (CLASS 56) | LF |
| 1521.079 | 12" DUCTILE IRON PIPE (CLASS 56) | LF |
| 1550.100 | HYDRANTS - REMOVED AND RESET | EA |

END OF SECTION

NOTES TO THE DESIGNER

- A.** Any request to modify or waive the specification requirements listed below must be approved in writing by the MBTA's Director of Design:

1. None